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ON THE HABITS AND BEHAVIOR OF THE HERRING GULL, *LARUS ARGENTATUS* PONT.

BY R. M. STRONG.

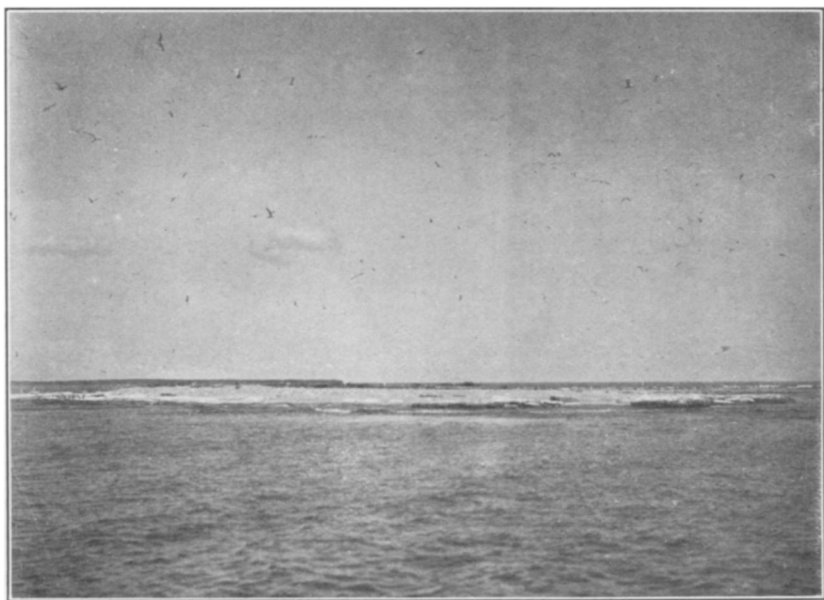
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I. INTRODUCTION.

It is the purpose of this paper to describe the results of work which was begun with the idea of studying bird habits intensively. I learned through Mr. Henry L. Ward, curator of the Milwaukee Public Museum, that colonies of Herring Gulls were to be found breeding on islands off both coasts of the peninsula which forms Door County, Wisconsin, i. e. in Green Bay and in Lake Michigan (See Fig. 1.)

These birds seemed to be especially favorable for my purpose because: (1) they nest in rather compact colonies on the ground and in more or less open places so that many individuals can be seen and studied to advantage, and (2) their considerable size and largely white plumage make them among the best bird subjects for the indispensable photographic records. Furthermore, I had already had some experience with these birds, especially during



1. THE STRAWBERRY ISLANDS FROM THE EAST. ISLAND ON LEFT OCCUPIED BY GREAT BLUE HERONS, OTHER TWO ISLANDS BY HERRING GULLS.
2. GRAVEL ISLAND.

July, 1907, when I visited a breeding colony at Gull Island in Lake Superior, near Marquette, Michigan.

On June 20, 1911, I made a preliminary exploring trip in Green Bay starting from my headquarters at Ephraim, Wisconsin. With the aid of a motor boat, the Strawberry Islands, the Sister Islands,

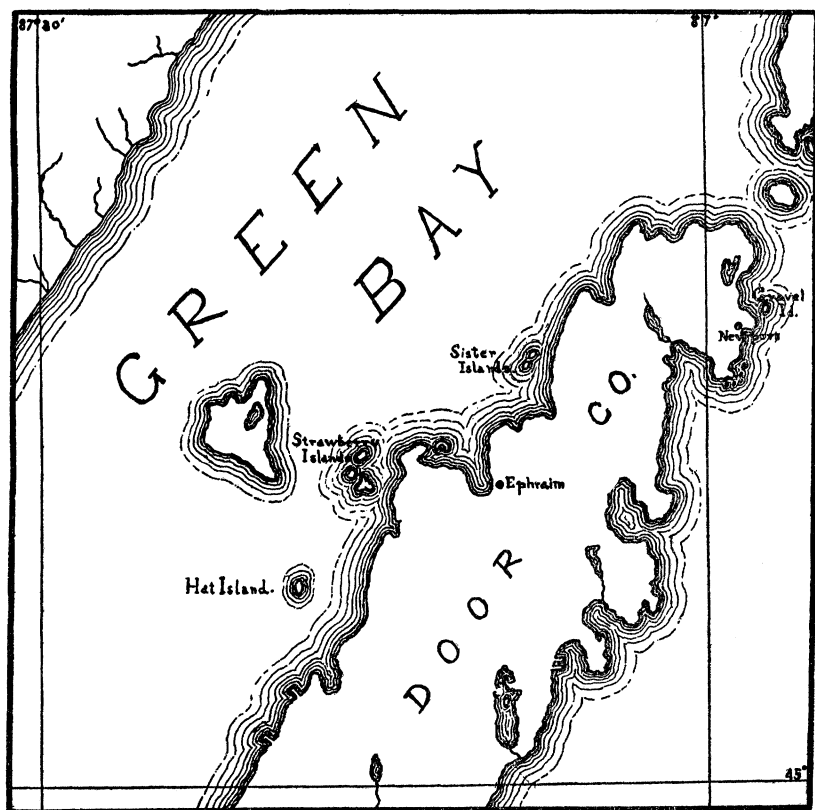


Fig. 1. Map showing locations of Gull colonies in region of Green Bay, Wisconsin.

and Hat Island were all visited during the day, and colonies of Herring Gulls were found breeding on all of these islands except at the largest of the Strawberry Islands (See Plate III, Fig. 1) which supported a colony of Great Blue Herons.

As it did not seem practicable to attempt to live on any of the

islands, I thought it best to stay at Ephraim and depend upon small boats for transportation whenever a visit was made to the gull colonies. Unfortunately, boats were not always available and the weather was not favorable on many days. Work was carried on at the Sister Islands on June 26, July 12, and July 15; at Middle Strawberry Island on June 30 and July 29; and at Gravel Island July 18 and 19. Another period was spent at Middle Strawberry Island beginning at 7:20 P. M., July 7 and ending the next day at 7:05 A. M. So much time was taken by preliminary studies that my experimental work at the breeding places was barely begun when the season ended.

Other experiments were begun with some juvenal gulls which were taken from their nesting places to Ephraim and were kept in a pen (See Plate IV, Fig. 2). These birds were removed to Chicago in August where experiments with them are still in progress. References will be made in this paper to observations made on these captive gulls. The work in Chicago has been made possible through the kindness of Professors Angell and Carr of the Department of Psychology, in giving me outdoor cage accommodations.

The only species of gull discussed in this paper except where otherwise stated, is the Herring Gull.

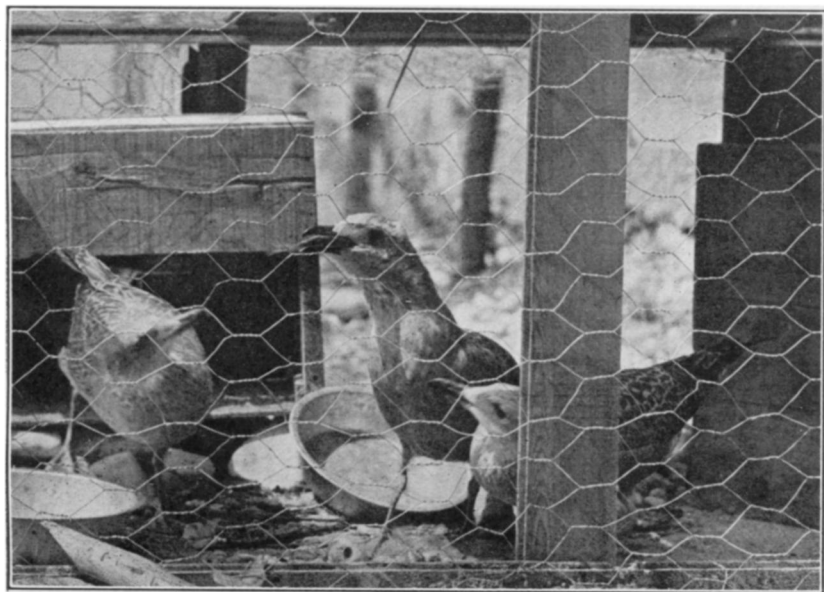
II. METHODS.

Like other observers, I found a tent or blind indispensable for the study of the birds at their breeding places. On approaching a breeding colony of gulls a wild panic begins which does not cease so long as the intruder appears to be in the immediate vicinity.

I had a tent made similar to that described by Sawyer,¹ with some modifications. It was about four feet high and six feet long at the bottom. The cover was made from dark green cambric lining cloth, costing seven cents a yard. The entire cover could be folded into a package small enough to go into a coat pocket.

After the first trip, extra openings were made to facilitate taking

¹ Sawyer, E. J. A Special Bird-Blind. *Bird Lore*, Vol. XI, no. 2, March-April, 1909, pp. 71-73. One page of text figures.



1. BLIND ERECTED ON MIDDLE STRAWBERRY ISLAND.
2. JUVENAL GULL SWALLOWING FISH ABOUT TEN INCHES LONG.

photographs in various positions. When not in use these apertures were closed by cloth doors which were provided with hooks and eyes such as are used by dressmakers, but of extra large size. An opening about five inches square in the top served quite successfully for ventilation.

Such a tent can be set up on rocky places where stakes cannot be used; and there are no guy lines to obstruct the camera field. It is possible to see more or less of what is going on outside of the tent through the cloth itself, although holes of small size give a clearer view. When dark clothing is worn, one's movements inside are not noticed.

The lower margin of each side and end of the tent was held down by a pole which ran through a hem in the cloth, and the ends of the poles were anchored with weights when a wind was blowing. Thus in Plate IV, Fig. 1, pieces of wood appear at the corners, for this purpose. A brisk breeze was blowing when the picture was taken as may be seen in the bellying of the side of the tent.

This tent with considerable additional anchorage in the form of rocks went through an unusually violent storm without injury or displacement. Only a small portion of the heavy fall of rain came through the cloth. It was found wise to carry permanent tent poles carefully fitted to the corner blocks, in a bundle as a part of my outfit. Drift boards were used as a floor.

The chief objection to this form of tent is that it is not high enough to permit the observer to stand upright. During a long day, I could not avoid becoming much cramped even when I tried shifts from a sitting to a reclining position and so on. I have since used a tent of similar form but larger and over six feet tall. The poles are all of bamboo and the corner fittings are of brass. The number of openings has been reduced but they have been placed in carefully selected positions. The sides and ends are all sewed together except at one corner where the entrance is placed. Tapes are provided for closing the entrance. This tent is much neater and far more comfortable, and it can be set up with the adjustments of equipment in less than fifteen minutes.

I found it necessary, as has been the experience of others, to have a companion leave the tent after having been inside with me. He would also leave the island with our boat, and he would not return

until a time agreed upon for the trip home. During this period I could not emerge myself without spoiling all chances for the day. After the departure of my companion, the apparently normal life of the colony was largely resumed in a few minutes. This precaution was not observed at Gravel Island, and the gulls there did not come very near the tent during the several hours my companion and I spent in the tent. Apprehension was shown in other ways, also. Ward's experience at Gravel Island when he had no one to leave the tent was similar and his account¹ follows. "The next time that I visited the colony, three days later, I was alone. I beached my boat, set up my tent and entered. Six minutes later the first of the young reached the island, followed two minutes later by the settling of the first adults, some on the island at its most distant point, but most in the water. It was an hour and thirty-five minutes before any came close to the tent, and not until half past four the next morning, or thirteen hours after setting up my tent, did the first one alight on it. The gulls on this occasion were quite uneasy and were frequently thrown into a panic by their own actions. The sudden alighting of a bird, or a fight between two, would frighten one, who, not waiting to see what was the trouble, would take wing, followed by one after another as the panic-formed wave swept over the island, leaving it almost bare of gulls. Fortunately they quickly recovered and returned, but their alertness and the frequent '*wak-wak, wak, wak*' of their note of suspicion showed that something bothered them. Apparently the departure of two people and the boat the first visit had deceived them into thinking that all had left the island, while on the second trip, although I had disappeared, yet no one had left the island, and for thirteen hours they remembered this and were suspicious. After the first gull lit on the tent they abandoned their suspicions and were as familiar with it as on the previous day."

A small folding camp chair was found a great convenience, but boxes are often available on a beach and these serve very well as a seat.

Two cameras were used, one a 5 × 7 Graphlex with a Tessar

¹ Ward, H. L. Notes of the Herring Gull and the Caspian Tern. Bull. Wisconsin Nat. Hist. Soc., Vol. IV, No. 4, October, 1906, pp. 113-134, 2 plates.

lens, and the other a folding tripod camera size $3\frac{1}{4} \times 4\frac{1}{4}$ inches with both a lens shutter and a focal-plane curtain shutter. The smaller camera was more often used, and frequently with only one of the two combinations of the convertible lens which it carried. I have found a convertible lens exceedingly useful in bird photography as a long-focus lens is frequently needed. It has been my experience that it is not practicable to use large diaphragm openings in bird photography because of the flatness of the field which they involve when the camera is as near as is necessary for photographing birds. I rarely use an opening larger than U. S. 8 or F. 11.

III. SOCIAL OR COMMUNITY RELATIONSHIPS.

An interesting analysis of a Herring Gull community has been made by Herrick.¹ He speaks of "family-units" and "family domains" which he says are guarded "with relentless vigilance." These precincts may be small and close together in a crowded breeding place.

There is also much evidence of coöperation. Thus Herrick mentions the fact that Herring Gulls will "attack a common enemy, such as bird, beast or man, with a certain degree of concerted action."

Herring Gulls are frequently to be seen together in flocks away from a breeding place. Mackay,² however, did not regard them as truly gregarious. Thus he says "they apparently only come together when there is some particular reason for doing so, as for instance something to eat, or to roost on some sand shoal or rest, and not apparently because they *like* to be together." Lucas³ disagreed with this conclusion as follows: "I should have said that gulls scattered in search of food at high water, but came together sociably at other times." My own observations agree with those of Lucas. These birds are usually to be seen in the company of

¹ Herrick, F. H. 1909. Organization of the Gull Community. Proc. Seventh International Zool. Cong., Boston, 1907, 3 pp.

² Mackay, G. H. Habits of the American Herring Gull (*Larus argentatus smithsonianus*), Auk, Vol. IX, 1892, no. 3, pp. 221-228.

³ Lucas, F. A. Habits of the Herring Gull. Auk, Vol. IX, no. 4, pp. 388-9.

other individuals, often in vast flocks. It may be questioned whether the gregarious habit implies fondness of the members of a company for each other.

Both juvenal and adult Herring Gulls seem to prefer the company of other individuals of their age. My captive gulls and those I have seen wild are usually to be found in close groups, especially when at rest. However, they are often cruel to each other and like other animals will fight fiercely for food.

A large amount of fighting occurs at a breeding place where no struggle for food is involved. Some of the encounters are undoubtedly the results of intrusions upon a nesting precinct as is Herrick's opinion, and I saw adults resenting attacks upon the young by other adults. Many of the fights, however, seem to indicate simple belligerency. A gull will approach another with head somewhat lowered and bill pointed straight forward or slightly upward. They will then grasp each other by the mandibles and attempt to drag each other about. Blows may be given with the wings and even with the feet. In Plate V, Fig. 1, such an encounter appears. The gull on the right is shown just at the moment when its wings have struck its opponent. The heads of the combatants appear in an oblique position as a consequence of the locking of mandibles. Frequently other gulls will join in the fracas and quite a lively but usually short and harmless tussle follows. I saw one fight broken up by another bird interfering much as a rooster may interfere in an encounter between two other cocks. Often a challenge to fight is not accepted, and the bird approached simply retreats.

Various writers have mentioned the killing of young gulls by adults. According to Ward¹ this may be a very common occurrence. He saw "some dozens" of half grown gulls which appeared to have been killed by adults, and he described the performance in considerable detail. The following is taken from his account which agrees with my own observations. "The main point of attack was the back of the head. To this region a number of severe blows were given with the point of the bill, after which it was grasped

¹ Ward, H. L. Why Do Herring Gulls Kill Their Young. *Science*, n. s., Vol. XXIV, 1906, No. 619, pp. 593-4.



1. HERRING GULLS FIGHTING.
2. PARENT FEEDING NEWLY HATCHED YOUNG.

between the mandibles of the adult and the bird was pulled about until the skin and flesh were cut through to the skull."

This maltreatment of the young has also been described by Dutcher and Baily¹ and it has been discussed by Herrick. I found that similar treatment was administered to a juvenal gull when it was placed in a cage with two juvenals two to three weeks older. One gull, the youngest of the three in the cage, was particularly persistent and savage in its attacks so that I had to remove the newcomer until its head had healed and it was better able to defend itself.

On erecting my tent at one of the Sister Islands, July 12, 1911, I took a downy juvenal not more than a week old, inside with me. This I released at 12:50 P. M., and it made its way out at once. Its appearance outside caused great excitement. The little gull started west in the direction of the place where I had captured it. On its way it went near a couple of gulls which appeared to belong to a nest I had under observation. These birds started the "challenge cry," and others joined in the same performance. The small gull approached the two adults just mentioned and was pecked on the head after a minute or so. It was next given a number of sharp blows which apparently did no serious damage. The little bird turned at bay and when pecked most severely ran screaming with mouth open, towards its persecutors. This was followed by alternate running and fighting, a procedure which was successful in preventing further serious attacks. The bird eventually found shelter under some drift wood about fifty feet away from my tent.

Herrick explains these attacks upon the young as follows: "This is due to the ferocity of the guarding and fighting instincts in the old birds, and to a lack of attunement in the instincts of the young, in consequence of which a chick will occasionally stray from its own preserve and trespass on the domain of a neighbor." Undoubtedly this covers many and perhaps most cases, but it seems doubtful whether the deaths among the juvenals at Gravel Island

¹ Dutcher, W. and Baily, W. L. A Contribution to the Life History of the Herring Gull (*Larus argentatus*) in the United States. Auk, Vol. XX, 1903, No. 4, pp. 417-31. Plates XXI-XXII.

can be explained as easily. There both Ward¹ and I found a promiscuous herding of juvenals without regard to precincts at least when the birds were of good size. Furthermore, it does not account for attacks upon juvenals by other juvenals.

During the winter of 1912-3, a wild Herring Gull with a broken wing was left in a basket at my door. It was evidently in the second year and of the same age as the gulls which I brought from Green Bay in 1911. After a few days, noticing that the injured gull carried the wing free from the ground, I placed it with the other two gulls. They at once approached in belligerent attitudes. The newcomer faced them with its head up in dignified defiance, and it was not attacked. Of course I do not know what encounters may have occurred during my absence, but ever since its introduction this bird has been master at feeding time, even with a wry wing. It is not larger, and it recently appeared much smaller as a consequence of poor condition.

A somewhat similar performance occurred when a young crow which had developed enough to fly well, was placed in the gull enclosure. The gulls advanced with threatening actions and even pecked the crow on the head. The latter bird maintained an air of unconcern giving little attention to the gulls who ceased troubling it after a few moments. The crow became at least their equal in bluffing, and I have recently seen it drive all three of the gulls away from the food dish without a battle. The extent to which the gulls submit to the crow, however, seems to vary inversely with their hunger.

Other birds may nest in apparent safety upon an island even fairly densely populated with gulls. Spotted Sandpipers, Bronzed Grackles, Song Sparrows, and other land birds were more or less common nesters on the Strawberry Islands. I found Red-breasted Mergansers nesting on all of the wooded islands occupied by gulls. So far as I could see, no attention was paid to these birds by the gulls. On the other hand, a large bird like the Great Blue Heron seemed to be viewed with disfavor, and I did not find both occupying the same island. On one occasion, I saw a Great Blue Heron pursued and much harassed by gulls.

¹ Ward, G. L. Notes of the Herring Gull and the Caspian Tern. op. cit.

I have always found Herring Gulls nesting on islands not inhabited by man, but exceptions occur in the literature. A very large colony of gulls studied by Dutcher and Baily was found nesting on Great Duck Island which has a light house.

Though the Herring Gull seems to prefer remote places for nesting, it is a matter of common observation that at other times if unmolested, it does not hesitate to frequent large cities where bodies of water with food occur.

IV. FEEDING HABITS.

The Herring Gull is generally recognized to be almost omnivorous in its feeding habits. It is especially known and prized as a scavenger. I have found that fishermen appreciate its habit of ridding the water of dead fish. It has been my observation that fish, especially when fresh, are preferred by gulls; but when hungry they take almost anything in the animal food line and many forms of plant matter. Dutcher¹ mentions insects including large numbers of ants as eaten by Herring Gulls. Eifrig² noted the occurrence of shells, seeds, berries, and a crab in the stomachs of three adult Herring Gulls taken May 29, June 10, and June 15. According to Knight,³ sea-urchins and star-fishes are eaten. Various molluscs and a crustacean are mentioned by Norton,⁴ and Audubon⁵ states that eggs are sucked. There is even a record of the capture by a gull of a bat⁶ which had been flying about over a river where gulls occurred. Various molluscs are mentioned by Mackay as gull food.

My captive gulls when very hungry will eat bread, but they prefer animal food. Their main article of food is liver with occasional feedings of fish scraps. When live fish are caught, the Herring

¹ Dutcher, W. Report of the Committee on Bird Protection. *Auk*, Vol. XXI, 1904, No. 1, pp. 164-5.

² Eifrig, C. W. S. Notes on Northern Birds. *Auk*, Vol. XXIII, 1906, No. 3, pp. 313-8.

³ Knight, O. W. *The Birds of Maine*. 1908, p. 49.

⁴ Norton, A. H. *The Food of Several Maine Water-Birds*. *Auk*, 1909, Vol. XXIV, No. 4, p. 438.

⁵ Audubon, J. J. *Ornithological Biography*. Edinburgh, 1835, Vol. III, p. 591.

⁶ Rodger, A. M. Herring Gull (*Larus argentatus*) capturing a Bat. *Ann. Scott. Nat. Hist. Soc.*, 1903, p. 51.

Gull may immerse its head and a large portion of its body, but I have never seen complete immersion. The bird may fly down to the water for food, but it does not dive vertically as terns do. Other writers have made similar observations. The following is taken from Townsend's account of the Herring Gull. "When after small fish or objects below the surface, Herring Gulls throw themselves with some splashing and wings partly spread, head foremost into the water and on rare occasions with such force as to submerge themselves. In these plunges they shoot down obliquely with backs up . . . I have seen them while riding the water on a rocky shore, occasionally fly up into the air a few feet to get an impetus, and then plunge into the water so that only the tips of the wings and tail were visible, coming up with molluscs and rock-weed in their bills."

Pieces of food not too large are swallowed entire, and the mass may be relatively great (See Plate IV, Fig. 2). Mackay¹ described the great swallowing capacity of the Herring Gull as follows: "I have known both the adults and young birds to swallow a dead pollock head first, the estimated measure of which was ten inches long by two inches in diameter at the thickest part." One bird known as "Gull Dick," and to be mentioned again in this paper would swallow six or eight pieces of pork the size of a hen's egg when hungry, according to Mackay. My captive gulls have swallowed fish of the size mentioned above on a number of occasions. Under ordinary conditions in cool weather, one of my birds will eat four to six ounces of beef liver at a meal when fed once a day, and it will be thoroughly hungry the next day.

According to Townsend,² Herring Gulls "eject the harder particles of their food, and balls of crabs, clams and fish bones entirely cleaned of flesh are scattered about their resting places on the beach. These balls are sometimes two inches in diameter; they are loosely compacted and soon fall to pieces. They often contain bits of feathers or down."

An interesting habit of the Herring Gull is described by Town-

¹ Mackay, G. H. op. cit., pp. 222-3.

² Townsend, C. W. *The Birds of Essex County, Mass. Memoirs Nuttall Ornithological Club*, 1905, No. 3, p. 91.

send ¹ as follows: "They may often be seen flying nearly straight up or in circles, with a clam or a crab, which they drop from a height, follow closely the descent, and alight to regale themselves on the exposed contents. If they fail to break the shell the first time, they try again. This habit, which is also a common one with Crows explains the fact that mollusc shells, crabs, and sea urchins are scattered along our coast, sometimes half a mile from the sea." Anthony ² states that this is a habit of various gull species, and he says "the clam was as often dropped on a soft sand beach as otherwise, and after repeated efforts the gull seemed unable to understand why the shell was not broken. Possibly a few yards distant a rock beach would have furnished all that was necessary to make the effort successful." Audubon ³ also described this method of breaking mollusc shells.

The feeding of the young by the parents will be discussed in the section devoted to the care of the young.

V. BREEDING HABITS.

1. *Mating*.—My field studies with gulls in both 1907 and 1911 were carried on after mating had apparently ceased. Most of the observations described by others do not include mating. At Great Duck Island off the coast of Maine, the breeding gulls are stated by a resident ⁴ to arrive each year in March. They are said not to be mated when they arrive. After mating is completed, nest building begins. This is about the middle of May or later. A short but interesting account of the mating behavior is given by Audubon.⁵

A peculiar performance has been observed by Ward ⁶ which he compares to the dance of the albatross described by Fisher, but its relation to mating is uncertain. Copulation also has been described by Ward.

¹ Townsend, C. W. op. cit., p. 96.

² Anthony, A. W. Random Notes on Pacific Gulls. Auk, 1906, Vol. XXIII, No. 2, pp. 129-7.

³ Audubon, J. J. Ornithological Biography. Edinburgh, 1835, Vol. III, p. 592.

⁴ Dutcher and Bally, op. cit., p. 431.

⁵ Audubon, J. J. Ornithological Biography. Edinburgh, 1835, Vol. III, p. 590.

⁶ Ward, H. L. Notes of the Herring Gull and the Caspian Tern. Bull. Wisc. Nat. Hist. Soc.

2. *Nest Construction.*— I have seen no nest building operations by gulls, and I had no evidence of any nest building being attempted during my visits to the colonies. However, I found nests in early July which seemed to have been constructed very recently. Herrick¹ speaks of "brand new nests" made in late July never to be occupied. The nests, as has been stated by others, are usually fairly bulky and of varying materials. Apparently grass, fine weed-stems, and feathers are preferred as these occurred in the majority of nests. Sometimes, however, nests were made largely of strips of bark or of coarse weed stems. Other beach debris may be used, especially the finer or softer materials. Bits of bark and other coarse materials appear in the nest which is shown in Plate VI.

The nests are mostly saucer shaped (see Plate VII, Fig. 1). They have been described in detail by Ward² who also gives measurements. Dutcher and Baily also give measurements in their article.

Although Ward's studies were made as late as the first week in July, he³ observed that "Incipient nest building was going on continuously." However, he saw no nest making that seemed likely to be carried to completion. Herrick⁴ made similar observations.

A description of actual nest building is given by Ward in the case of the so-called incipient nest building which he observed.

As has already been stated in the introduction to this paper, a great variety of locations may be chosen for the nest. In general, it seems that uninhabited islands are preferred, where the nest may be anywhere on the beach or back some rods from the open beach in bushes, among tall herbaceous plants, or in grass, or upon rock ledges. Often the shelter of a drift log is chosen (See Plate VII, Fig. 2). Nests may be placed in trees under certain circumstances, a point that will be discussed elsewhere in this paper.

Much of the grass used in the nests is growing when pulled up by the birds, according to Dutcher and Baily. They have also described one nest as composed entirely of fresh green material.

¹ Herrick, F. H. *The Home Life of Wild Birds*, p. 163.

² Ward, H. L. *Notes of the Herring Gull and the Caspian Tern*. p. 116.

³ *op. cit.*, p. 131.

⁴ Herrick, H. F. *Home Life of Wild Birds*.



HERRING GULL WITH NEWLY HATCHED YOUNG AT NEST ABOUT SIX FEET FROM BLIND. NOTE THE COARSE NEST MATERIALS.

They observed much repairing of the nest with green grass or weeds during incubation.

There is a description ¹ of a nest placed 60 feet above the ground and composed of "long, firm, flexible grasses, evidently gathered when green from the salt marshes, and carefully woven into a circular fabric." It is stated that this nest could be handled without coming to pieces.

Herrick ² also speaks of the habit of pulling grass "all summer long," which is sometimes carried to the nest, and he gives an interesting description of a mid-July revival of the nesting instinct.

3. *Brooding*.—According to data given by Dutcher and Baily,³ which was reported to them by a resident of the island where their work was done, the period of incubation is a little less than four weeks, usually. The following is taken from their account: "The first egg was found May 15, and the first completed set of three eggs on May 22. The last set of eggs hatched August 3-5. Fifteen nests were marked and watched in order to determine the time occupied in incubation, which proved to be as follows: 1 in 24 days; 2 in 25 days; 5 in 26 days; 4 in 27 days; 3 in 28 days."

As the males cannot be distinguished from females by their plumage, ordinarily, it is difficult to get data concerning the relative parts taken by the two parents in brooding. Dutcher and Baily obtained evidence that both parents take part in brooding the eggs. They state ⁴ that: "On one occasion, while photographing gulls on nests, it was noted that the first bird that occupied the nest, after the camera was focussed, had a number of dark feathers on its breast; after it had left the nest a bird with a pure white breast occupied it. That this was a mated pair there is no reason for doubt, for they were together, and both exhibited the greatest solicitude for the nest and its contents." They also observed that the stage of incubation could be determined by the increasing anxiety of the parents as the end of the period drew near. On the same page the following occurs: "During the last few hours before the pipping or

¹ Baird, Brewer, and Ridgway, Vol. II. *The Water Birds of North America*. p. 239.

² Herrick, F. H. *Home Life of Wild Birds*, p. 163.

³ *op cit.*, p. 431.

⁴ *op. cit.*, p. 426.

cracking of the egg the parent birds were so fearless that they would leave the nest only on a near approach, and while the camera was being focussed would remain within a few yards, perched either on the ground or on a low tree or stump." This change in behavior towards the end of the incubation period is of course not peculiar to gulls.

Some observations were made by Dutcher and Baily¹ on the turning of the eggs by the brooding bird. They found that the eggs are sometimes turned slightly with the bill when the bird goes on the nest, though in one case where each egg had been marked with an arrow, only one was found turned after the bird went on the nest. I also obtained some evidence of the eggs being turned by the bird. In some cases, as the parent nestled down over the eggs it appeared probable that at least a slight turning of eggs would occur. There was usually more or less shifting of the feet, body and plumage, as the bird adjusted itself to the eggs and nest. This performance has been described in detail by Dutcher and Baily.²

On very warm days, especially at midday, I found that the nest is left frequently for a few moments. At such times the bird goes to the water's edge and takes at least a partial bath. There is much splashing of water with the bill and sometimes with the whole head. There is some drinking of water also at this time.

Another phase of the brooding activities is the repelling of intruders from the vicinity of the nest. According to Herrick,³ one of the parents is on guard most of the time after the eggs hatch, for several weeks. He says also that the guarding bird stands on a perch which is maintained by habit. Dutcher and Baily also mention this guarding habit, and I have also noticed it. According to Hornaday,⁴ a pair of Herring Gulls bred successfully in Bronx Park Zoölogical Gardens. He states that the male "bluffed or fought everything coming within ten feet of the nest." During a battle, the sitting female would point her bill toward the sky and scream.

So far as I could determine, there is more or less brooding of the

¹ op. cit., p. 427.

² op. cit., p. 427.

³ Herrick, F. H. Proc. Seventh Internat. Zool. Cong.

⁴ Hornaday, W. T. The American Natural History, p. 297.



1. CHARACTERISTIC GULL NEST ON ROCK LEDGE AT GULL ISLAND
NEAR MARQUETTE, MICH., IN LAKE SUPERIOR.
2. HERRING GULL ON NEST.

young for several hours after hatching or until they are able to run about. Often on a hot day, one of the parents would simply stand over the newly hatched nestlings shading them from the sun. Plate X, Fig. 1. The other parent was usually near by and it would change places with its mate at intervals.

I doubt whether there is much covering of the young for more than a day or two after hatching, in pleasant weather. No observations were made in bad weather of the treatment of very young birds.

The eggs (see Plate VII, Fig. 1) have been fully described by many writers, especially in general works on birds. Detailed descriptions are given by Dutcher and Baily of some of the very numerous and great variations. Good descriptions occur in Ward's paper.

4. *Care of young*.—Concerning the care of the young by their parents, much remains to be learned. The brooding and shading of the newly hatched young has just been described. I obtained considerable evidence that both birds participate in feeding the young. According to Herrick,¹ the young gull receives its first food in about one hour after hatching, at the nest.

The larger juvenals tease vigorously for food when hungry and the whole feeding performance for a young gull more than a few days old has been well described by Ward²: "The young comes in front of an adult and with a bowing and courtesying movement put up its bill to that of the old one, continuing the bowing for several minutes, resting between times. Sometimes it took hold of the adult's bill with its own, at other times merely touched bills. When the adult opened its mouth the young put its bill within. Failing to get indications of food, it went to another adult, and repeated the operation, passing in succession to several, until at length it seemed to get some favorable signs, for it remained by this one, alternately begging and resting. After some time it was apparent to me that the adult was striving to regurgitate. It would open its mouth, stretch its neck nearly horizontally, then bring its head down to the ground. After a moment it will close its bill, turn its head to one side and look at the ground over which it had

¹ Internat. Zool. Congress Report. op. cit.

² op. cit., p. 121.

been straining, as though expecting to find something there. Other gulls were from time to time attracted to the scene, but were promptly chased away by this bird, who ran rapidly at them with open beak and outspread wings. Perhaps half an hour after these efforts began I saw a portion of a fish appear in its mouth, and a moment later it was deposited on the ground, when the young promptly seized it. The fish appeared to be a herring about 7 or 8 inches long and so mascerated that it readily fell apart. The adult assisted in breaking it up, and I saw it pick out the vertebral column, which it dropped with the other pieces."

"The young fed mostly from the ground, but occasionally snatched a piece from the bill of the adult. . . . After some minutes I noticed that regurgitation was apparently to be repeated, and in about a quarter of an hour the remains of another fish were deposited on the ground and disposed of in the same manner."

The newly hatched young, according to my observations are more passive, and I obtained some evidence that the parent may initiate the feeding performance. Similar conditions occur in the feeding of young pigeons. On June 30, 1911, while taking observations on one of the Strawberry Islands, a pair of gulls whose nest was about five feet from the base of my tent fed two young not many hours old and still too weak to walk well, at irregular intervals within eight to ten feet from my point of observation. The little gulls had been coaxed away from their nest for a few feet by their parents, a distance which they covered with difficulty.

The following notes concerning the observations just mentioned have been taken from my note book. The bird shading its young was relieved at 12:40 P. M., and went down to the water for a drink. The other parent at once proceeded to feed the young gulls while the first bird stood a few feet away at the edge of the water. The adult bird did not insert its bill in the mouth of its offspring but the latter took food from the ground just below the bill of the parent. Occasionally the young reached up towards the bill of the parent which was held low, often almost at the ground (see Plate V, Fig. 2). A quantity of food in a fine and soft condition was disgorged in more or less of a heap. After the young had eaten, the parent swallowed what was left. These very young birds ate slowly, apparently without much appetite. The whole performance passed off quietly and with no rapid movements.

At 1:45 P. M., I saw the same young birds being fed again. A little later, I noticed another feeding of some gulls a few days older. Small fishes appeared in the food disgorged by the parent.

In spite of the fact that the gulls seemed to settle down to normal activities during my tent work, I saw surprisingly few cases, relatively, of feeding the young. These were usually a little too far away to permit close observation, and it was seldom possible to determine by observation from my tent what the nature of the food was.

The stomachs of six young Herring Gulls "of different sizes" as reported by Norton,¹ "contained almost no fish but all contained ants in varying quantities, only one being full."

Where many young gulls occur in a relatively small area, it is difficult to determine whether the adult birds always feed only their own young. The small amount of evidence I obtained suggested that the parents, usually, feed their own offspring. But it is of course possible that birds usually feeding their own offspring, may occasionally give food to other juvenals.

At Gravel Island there was apparently considerable promiscuous feeding according to the observations of both Ward and myself.

I observed adult gulls alighting near close flocks of young birds on a number of occasions, at Gravel Island. Each time the juvenals surrounded the adult like a pack of wolves, and it was often completely hidden from my view by the struggling young gulls. In Plate IX such a scene appears. Such a performance was usually accompanied by considerable noise made by the hungry birds. Other adult birds sometimes added to the clamor by screaming. The general excitement is shown in the illustration just mentioned.

The period during which the young are fed is evidently a long one. I saw young birds which must have been at least six weeks old, and probably considerably older than this, still being fed by adult birds. It is of course possible that young birds may be obtaining some of their food themselves before all food giving by their parents or by other adults ceases.

On a few occasions, I saw adults apparently resenting the ap-

¹ Dutcher, W. Report of Committee on Bird Protection. Auk, 1904, Vol. XXI, No. 1, p. 164.

proach of other adults to their young, but data of this sort are very meagre. These observations and those quoted in this paper from Herrick and Hornaday, however, make it probable that the young are guarded for at least a considerable time after hatching by their parents.

I have been unable to obtain data concerning the relationships of the parents to the young when the latter are learning to take care of and feed themselves. Adults and young roam about together in flocks for weeks or months after the young are able to fly.

5. *General Behavior of the juvenal gulls.*—The behavior of the young just after hatching has been described by Ward.¹

According to Dutcher and Baily² "The instinct to hide seems to be developed within an hour or two after hatching, or so soon as the young bird is strong enough to walk." My own experience is that the instinct to hide is not always developed thus early. On July 6, 1907, at Gull Island near Marquette, Michigan, in Lake Superior, I found a nest containing one single nestling which stood up pertly in its nest and did not give the usual indications of fear (see Plate VIII, Fig. 1). The plumage of this bird was dry, and it was able to stand. On the same day, another nest was observed with two young and an egg in which the occupant was breaking its way out (see Plate VIII, Fig. 2). In this case the two nestlings showed very great fear and left their nest which was located on a small ledge of rock, squealing pitifully. They showed other signs of distress and began to pant. Mrs. Strong held an umbrella over the birds to protect them from the intense sunlight that prevailed. Nevertheless, before I had gone through the process of mounting a camera on a tripod and making one exposure, one of these birds died. Presumably the combination of fear and heat was responsible. The dying bird appears in the picture.

I agree with Dutcher and Baily that young gulls show the hiding instinct as soon as they are able to run about freely. During the pandemonium that prevails among the adults when one approaches the nesting place of a colony of gulls, the larger young not yet able to fly may be observed with the aid of strong glasses running about

¹ op cit., p. 120.

² op cit., p. 422.



1. NEWLY-HATCHED YOUNG SHOWING NO FEAR.
2. NEWLY-HATCHED YOUNG IN A PANIC OF FEAR

to places for hiding. On reaching shore all young birds able to leave their nests will be found hiding except those that have taken to the water. Those able to fly are pretty sure to join the adults in flying overhead, or they often alight on the water at some distance. This hiding instinct has been described in some detail by Dutcher and Baily.

At Gull Island in Lake Superior, I frequently saw half grown gulls running headlong over the rocky surface of the island after being removed from their hiding places. They would often fall ten or more feet over ledges to rocks below without any apparent injury or significant delay in their rush for the water.

According to my observations the young gull, when attempting to hide, especially if still in the down plumage, will remain perfectly quiet until it is handled or removed from its hiding place. After being disturbed in this way, however, the hiding instinct seems to be replaced by an impulse to flee and the bird, if not checked, will run in headlong fashion until it reaches water or gains a position where it is really out of sight, a number of rods away. Usually when such a bird reaches the water it will swim some distance from shore. I have observed the same behavior in the young of the Wilson's and Roseate Terns, *Sterna hirundo*, and *S. dougalli*. The Laughing Gull, *Larus atricilla*, apparently shows the same behavior, but I have not studied the habits of this species enough to make a complete comparison. Probably this hiding behavior is common to most species of the whole order, under similar circumstances.

In the case of the gulls hatched in tree nests, the behavior must of course be different. It is hardly conceivable that the young in tree nests as high as fifty feet above the ground, as some have been stated to be, can leave their nests before the flight feathers are well developed. Concerning this point we find Dutcher and Baily¹ saying: "The young in tree nests also seem to have sense enough not to walk off the edge of the nest, for in 1902 Mr. Baily found young at least ten days old in a tree nest."

As viewed from my tent, the young gulls appeared to spend most of their time standing idly about waiting for food. The

¹ op. cit., p. 422.

recently hatched birds were observed enjoying the shade of one of their parents when the sun was intense as has already been stated in this paper. They also used drift wood or anything else offering shade. The more developed juvenals, especially on warm days, did a large amount of bathing at the water's edge. Still older young would swim further out from shore in bathing. When the definitive feathers are developing and begin to burst from their sheaths, much time is spent in dressing the plumage with the beak. Whether the opening of the feathers is facilitated by the feather manipulation could not be determined.

6. *Development of bird after hatching.*—A detailed account of the hatching and early development of the young after hatching has been given by Dutcher and Baily.¹

Growth is rapid but the young are in the down plumage for a number of days after hatching. It is not in the province of this paper to give a detailed description of the plumage, and the reader is referred to the account given by Dutcher and Baily² (p. 422 with Plate XXII). The sequence of plumages has been described by Dwight.³ The dark plumage of the juvenal gull is replaced after the first winter by a lighter and less mottled plumage with quite a bit of individual variation in the rate of change, judging from my captive gulls. At two years, my gulls had lost most of their juvenal coloration. Strange to say the wild gull obtained in the winter of what must have been its second year, was somewhat behind the others when they were two years old. None of my gulls had acquired at two years as advanced a plumage as that described by Dwight for Herring Gulls of that age. Sharpe⁴ describes progressive changes extending through the first five autumns, and he says that the "quills" have more dark coloring at the fifth autumn than appears in older birds. The following quotation from Townsend's account of the Herring Gull agrees well with my observations. "It is superficially evident from the large number of dark and mottled birds at all seasons, that it takes several years

¹ op. cit., pp. 421-2.

² op. cit., p. 422.

³ Dwight, J. The Sequence of Plumages of the Laridae (Gulls and Terns). Auk, 1901, Vol. XVIII, No. 1, pp. 49-63.

⁴ Sharpe, R. B. Catalogue of Birds in the British Museum. Vol. XXV, 1896, p. 264.

to attain the beautiful adult plumage. What appears to be a dark tip to the tail, so prominent in young birds of a certain age, is often retained after increasing whiteness has set the stamp of years, but it is entirely absent in the snowy white tail of the fully matured bird. Birds with pure white tails with the exception of a slight central sprinkling of dusky brown and with a few faint gray streaks in the upper breast, are not uncommon."

My gulls acquired a yellow iris in the second winter, but they still in their third fall have the bill colored as in the first year. According to Astley,¹ the bill does not become yellow until the fourth year, although a nearly complete adult plumage appears at the third autumnal molt. Sharpe's account indicates that the adult coloration of the beak is not acquired until after the fourth autumn.

Very meagre data are available as to when breeding begins. A case is described by Dutcher² of a gull which apparently began breeding when two years old, and I quote the evidence given for this conclusion as follows. "In response to the question whether the dark colored birds ever mated with the white birds, Mrs. Stanley said that they did when they were two years old. Her reason for this belief was as follows: On one occasion a young gull had lost one of its legs just above the knee. The wound healed but the bird was a cripple and had to hop and stand on the perfect leg. They fed the bird, and it became very tame. In the fall it left with the other gulls and returned with them the next spring, exhibiting its old familiarity. That season when the bird was only one year old it did not mate. It remained on and about the island all the season, departing with the others on their southward migration. The following season it returned again and was still partially dark colored. It secured a white mate and raised a brood of young."

It is my judgment that Herring gulls rarely breed this early. I saw a few with a very small amount of the immature coloration in their plumage, which were certainly at least two years old. I obtained no evidence that these birds were breeding except the fact of their occurrence with breeding birds at a breeding place.

¹ Astley, H. D. *My birds in Freedom and Captivity*, p. 160. E. P. Dutton and Co., London, New York, J. M. Dent and Co.

² Dutcher, W. *Results of Special Protection to Gulls and Terns Obtained through the Thayer Fund*. *Auk*, Vol. XVIII, 1901, No. 1, p. 98.

All of the birds that I actually saw with eggs or young were adult, as far as I could see.

I have seen relatively few immature gulls during the spring and summer after their first winter, but this is probably due to their scattered distribution. Many individuals linger some distance south of the breeding range of the species. Thus Townsend speaks of immature gulls being abundant at all seasons off the coast of Essex County, Massachusetts, though Herring Gulls do not now breed south of Maine on the New England coast. Immature gulls are also seen over the south portion of Lake Michigan during the breeding season though the nearest breeding place is many miles to the north.

Concerning the longevity of the Herring Gull, I have found two records which indicate that the period of life may be considerable though giving no idea how long it may be. Thus Morris¹ mentions a Herring Gull which was being fed daily and was very tame. This bird is stated to have escaped thirty years before "from a garden where he had been a prisoner." Another bird known as "Gull Dick" is well known to ornithologists through the reports made by Mackay to 'The Auk.' He says that this bird² had "the habit of frequenting, and returning year after year to the waters adjacent to Brenton's Reef, Narragansett Bay, and was known in consequence to the crew of the lightship anchored in that locality . . . In 1891 the bird arrived October 12 which makes the twentieth winter it is known to have passed in this locality. This bird was identified each year partly by its tameness, and "also by certain marks on its wings, also by its cry." It was reported by Mackay during the following four years after which it failed to appear.

VI. VOICE.

1. *Introductory*.—During the summer of 1911, especially, I gave a large amount of attention to the sounds made by the gulls with the hope of making interpretations concerning their significance. Attempts to describe the various vocal performances were

¹ Morris, F. O. *A History of British Birds.* Vol. VI, p. 159.

² op. cit., pp. 226-8.

made whenever possible, with difficulties which will be appreciated by all observers who have tried to make descriptions of animal sounds.

Though I tried to notice anything that might have any bearing on the significance of the sounds made by the gulls, I had the following points especially in view: (1) the circumstances under which each sound was made, (2) any possible evidence of associated emotions, (3) the attention given by other individuals and especially by the young to these sounds. As all of the cries occupy only a few seconds at the most, it is necessary when in the field to be ready to give instant attention the instant the sound is heard. Here again we see the advantage of the presence of a considerable number of individuals at such close range as they can be at a breeding place. Some notes are not made frequently by a single individual, and the chances of hearing them are multiplied many times when the observer is in the midst of a fairly large breeding colony. On the other hand, of course, a large number of gulls in a limited area make a bedlam of noise which is often confusing. With careful concentration on single sounds or performances it is possible to reduce the confusion of sound to a working basis.

2. *The alarm cry.*—In my experience, whenever wild gulls are disturbed at their breeding places, at least by man, they become very noisy. Though other sounds are made, the characteristic and usual cry is what has been called by Herrick,¹ Ward and others the "alarm cry." This consists of sharp and short notes in doublets or triplets which are produced with great variations in quality and in pitch. I was unable to determine whether these variations are produced by different individuals. They are striking and always to be noted when a colony of breeding gulls is disturbed.

After trying various syllables to represent these sounds, I finally decided that the following is as satisfactory as anything I could devise, kek'-kek-kek, with an accent on the first syllable, the e being sounded as in deck. Often only two instead of three of these sounds are made in a group. These triplets or doublets are uttered in rapid succession as the bird flies about in the general panic.

Mackay² described the alarm cry with the syllables "cack,

¹ Herrick, F. H. *The Home Life of Wild Birds.*

² *op. cit.*, p. 226.

cack, cack," and Herrick¹ used the following: "waw-wak-wak! wak-wak! wak-wak!" Ward used the same symbols in his paper. Another rendering was made by Knight² as follows: "ha-ha-ha" or another alarm cry as follows: "qu-e-e-e-a-h que-e-e-e-a-h." He noted that these cries vary in the "intensity of their demonstration" depending on the contents of the nest (whether fresh eggs, incubated eggs or young are present) the amount of previous disturbance they have been subjected to, etc.

The alarm cry may be high and shrill or rather low with "chest tone" quality. Intermediate variations also occur. As the disturbance in a gull colony subsides, these notes are uttered less and less frequently, and the lower notes predominate more as the excitement decreases. The cries also become less loud and incisive, until as Herrick³ has expressed it: "Finally ceasing like a clock running down, the mandibles continue to work with no sound for a moment or so."

I have often heard these sounds made when the birds were apparently simply solicitous or slightly anxious concerning their eggs or young. Thus hours after the gulls had settled down to apparently normal activities about my tent, single birds would occasionally fly overhead making the alarm cry. At such times the cry is characteristically low and not at all shrill.

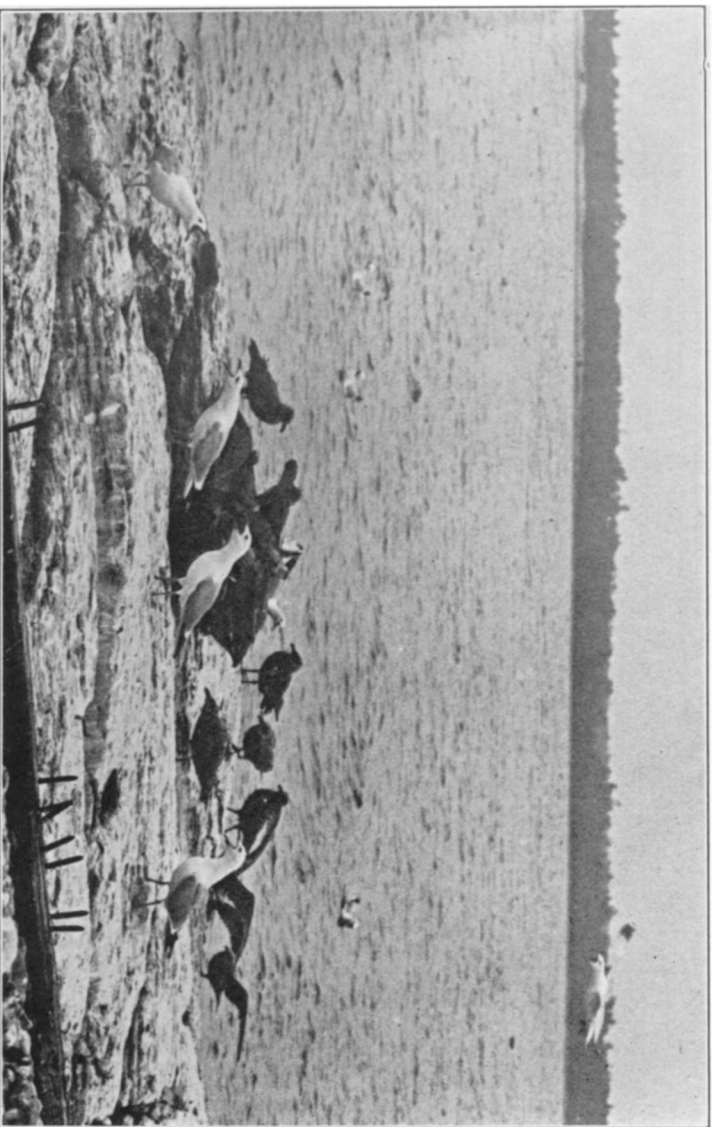
3. *The "challenge."*—This was for me the most interesting vocal performance, though it is less often mentioned by other writers. Herrick describes a "scream of defiance" and has a photo showing a bird making this noise. Ward is the only writer to my knowledge who has described this performance in any detail, and his interesting account follows.⁴ "Frequently, the general clamor would be dominated by a peculiar cry which I put into words as 'yeh, yeh, yeh,' rapidly repeated and increasing in vehemence to the utmost capabilities of the gull, when it quickly ceased. Usually, a few seconds after one began another joined, until often there were a half dozen birds screeching at once, and occasionally, this number would be increased to a score or more.... The bird stretches its

¹ op. cit., p. 55.

² Knight, O. W., op. cit., p. 48.

³ op. cit., p. 55.

⁴ op. cit., p. 130.



GULL SCENE AT GRAVEL ISLAND. THE DARK BIRDS ARE IN JUVENAL PLUMAGE. AN ADULT WITH FOOD IS HIDDEN BY THE JUVENALS. THE OTHER ADULTS ARE MAKING THE "CHALLENGE CRY."

neck downward, opens its bill widely and begins the call, then with a jerky sort of start it stiffly raises its outstretched neck, usually to an angle of about forty-five degrees. Generally, almost invariably, the head, neck, body and tail are all held in practically the same line and in a remarkably stiff manner. The whole performance is so machine like in its rigidity and precision of motion that the gulls appear like a lot of automatons." I have adopted Ward's term "the challenge" for this cry.

I made a number of records of the performance, and I add a few details to Ward's description. Just before the head is raised a single note which may be of appreciable duration is often made. This I tried to represent in my notes by the syllable "*keee*." It is followed by a series of high and shrill notes as described by Ward. I finally settled on the following representation in my notes: "*keee, kee' ek, kee' ek, kee' ek, kee' ek, kee' ek, etc.*" The *e* in *kee* is sounded as in *see* and this syllable is accented. The first note is longer. Although this noise seemed to take more time, I found on using a watch that it occupies only a few seconds. The performance, may, however, be repeated more than once during the course of a few minutes, when other gulls are "challenging."

In my experience the "challenge" call is usually made by a bird on or about the ground, but I have often heard swimming or flying birds make this noise. All of these situations are shown in Plate IX where a number of birds are seen in the performance. The three birds on land at the left and in front, give the best idea of the usual position.

Good pictures of gulls indulging in the "challenge" appear in both Herrick's and Ward's accounts of the habits of these birds.

Concerning the significance of the "challenge" performance, little more than opinions can be offered. It may sometimes be made when other individuals are frantically indulging in the "alarm cry." I have noted individuals going through this performance while flying about in the general panic which took place when I was landing at an island where gulls were breeding. This behavior often seems to indicate a belligerent attitude and it then well deserves the term "defiance cry" or "challenge." My observations lead me to agree with Ward in saying "Anything that startles the gull without producing a panic, or the proximity of

fighting birds, or even at times the approach of other gulls seems to be sufficient cause for its production."

My captive gulls have indulged in a performance which I have observed on a few occasions. This has appeared to be a developing challenge. The first efforts were made in their first autumn. The same positions were taken, and the sounds made were as similar as the first crowing efforts of a young rooster are to the crow of a mature cock. The last attempt was observed in the early summer of 1913. As my birds have attempted the challenge only on rare occasions, I have not been able to study its characteristics satisfactorily. Each time the performance was begun without warning, and it was over in a few seconds. On each occasion a contest over food was in progress, although the bird making the noise was not always engaged in the struggle. Contests over food are exceedingly frequent, however, and the only sounds made, with these rare exceptions, consist of a shrill squealing chatter.

Adult birds in late summer after the breeding season is over make a cry which is at least similar if not identical with the "challenge," but I have not observed it at close range.

4. *Other cries.*—Though the "alarm" and "challenge" cries make up a large portion of the general clamor at a breeding place, especially when the birds are disturbed or excited, other sounds are also made. Of these a cry remarkably like the mewling of a cat is one of the most frequent. The birds I saw "mewing" held the neck arched and the head pointed downward. This performance often occurred when adults approached young birds apparently their offspring. It also seemed at times to be made in calling the young. The adult gull at the extreme right in Plate X, Fig. 2 is seen "mewing." This bird was engaged in coaxing its newly hatched young to a place not so near the tent, and they were too weak to do more than stumble along over the pebbly beach. The whole procedure was rather deliberate and more or less interrupted. Now and then the adult would make the mewling sound, and on one of these occasions I obtained the photograph just mentioned. Ward¹ observed another set of conditions under which the mewling cry may occur as follows: "The first day that I was in the tent,

¹ op. cit., p. 129.



1. PARENT GULL SHADING NEWLY-HATCHED YOUNG.
2. GULL AT RIGHT MAKING THE "MEW" CRY, VERY YOUNG OFFSPRING WALKING JUST BEHIND. OTHER GULLS SEEN IN CHARACTERISTIC LOAFING POSITIONS.

at 3 P. M. a rain squall came up. Dark clouds obscured the sun, occasional flashings of lightning were seen and peals of thunder sounded from time to time. The wind came in cold sharp gusts. The shrill cries of the gulls were quickly subdued and a plaintive mewling was the all-prevailing sound."

On a few occasions, I heard a shrill and prolonged cry which was distinguishable from the mew and yet apparently related to it in its characteristics. This I have represented in my notes by the syllable "kerr" with the *e* sounded as in her. It suggested to me a noise often made by a contented hen in the chicken yard. I was unable to get any clue to its significance.

A high-pitched kee sound is often made when the bird is flying. I have heard this given by gulls away from their breeding place. It is of appreciable duration, and it descends slightly in pitch.

Another performance which I noted only a few times involved a rapid series of weak notes not unlike the peeps of a newly hatched gull but with more of a whispering quality. This I represented as follows: "peep-peep-peep-peep-peep, etc." The beak was opened only slightly and shut with each note. It is possible that this is the "run down" alarm cry which Herrick mentions, but its occurrence was not connected with any apparent alarm nor was it closely preceded by alarm cries. The bird stood about in the position shown in Plate X, Fig. 1 and was very near my tent. The noise would not have been heard if the gull had been many feet away. Perhaps a fair guess would be to suggest that we had here an incipient alarm cry which did not involve a stimulus strong enough to produce the full response.

Young Herring Gulls give a cry for food which varies with age. The newly hatched birds utter only weak peeps. As they grow older, these develop into more insistent squealing notes which may be made with a bowing motion for each. When attacked or in distress, juvenal gulls often make a sharp and still more incisive squeal in which the notes are uttered more rapidly and more loudly. I have already mentioned the attempts at a challenge cry which are made by juvenals.

(*To be concluded.*)